

WHAT IS CLAIMED IS

1. An ignition control apparatus for an internal combustion engine comprising:

an ignition plug provided in said internal combustion engine;

an igniter introducing spark discharge in said ignition plug at an ignition timing; and

an ignition control means executing a multiple discharges operation in which a plurality of discharges are carried out during one combustion cycle of said internal combustion engine, wherein

said ignition control means changes a discharge period of each discharge during the multiple discharges operation, and

said ignition control means changes the discharge period of each discharge in accordance with a pressure transition in a combustion chamber of said internal combustion engine.

2. An ignition control apparatus according to claim 1, wherein said ignition control means sets the discharge period longer as fuel-air mixed gas supplied into said internal combustion engine is leaner.

3. An ignition control apparatus according to claim 1, wherein said ignition control means determines the number of discharges during the one combustion cycle based on a driving condition of said internal combustion engine.

4. An ignition control apparatus according to claim 1, wherein said ignition control means determines an interval of each discharge based on a driving condition of said internal combustion engine.

5. An ignition control apparatus according to claim 1, further comprising an ignition timing retarding means for retarding the ignition timing when said internal combustion engine cold starts, wherein

said ignition control means executes the multiple discharges operation in accordance with the ignition timing retardation when said internal combustion engine starts.

6. An ignition control apparatus according to claim 1, wherein

said ignition control apparatus is used for an injection inside cylinder type internal combustion engine in which a fuel is directly injected into a combustion chamber thereof, and

said ignition control means executes the multiple discharges operation in accordance with a driving range of said injection inside cylinder type internal combustion engine.

7. An ignition control apparatus according to claim 1, wherein

said igniter includes an ignition coil introducing the spark discharge in said ignition plug,

said ignition control means repeatedly energizes and

disenergizes a primary side of said ignition coil by plural times during the one combustion cycle of said internal combustion engine to execute the multiple discharges operation.

8. An ignition control apparatus for an internal combustion engine comprising:

an ignition plug provided in said internal combustion engine;

an igniter introducing spark discharge in said ignition plug at an ignition timing; and

an ignition control means executing a multiple discharges operation in which a plurality of discharges are carried out during one combustion cycle of said internal combustion engine, wherein

said ignition control means sets a discharge period of each discharge during the multiple discharges operation in such a manner that the discharge period is set shorter as the discharge timing more closes to a compression top dead center.

9. An ignition control apparatus for an internal combustion engine comprising:

an ignition plug provided in said internal combustion engine;

an igniter introducing spark discharge in said ignition plug at an ignition timing; and

an ignition control means executing a multiple discharges operation in which a plurality of discharges are carried out

during one combustion cycle of said internal combustion engine,
wherein

said ignition control means changes a discharge period of
each discharge during the multiple discharges operation.

10. An ignition control apparatus according to claim 9,
wherein said ignition control means restrict a range of the
discharge period by a predetermined guard setting minimum
discharge period.

11. An internal combustion engine control apparatus
comprising:

an ignition operating circuit; and

an injection operating circuit operating a fuel injection
valve, wherein

said ignition operating circuit and said injection
operating circuit are integrated with together, and

said ignition operating circuit and said injection
operating circuit commonly share a function device used for both
circuits.

12. An internal combustion engine control apparatus
comprising:

an ignition operating circuit;

an injection operating circuit operating a fuel injection
valve;

a control computer controlling said ignition operating

circuit and said injection operating circuit; and

a signal determining circuit provided between said control computer and said both operating circuits, wherein

said signal determining circuit carries out cylinder determination and ignition/injection determination based on combinations of a plurality of signals output from said control computer, and

said signal determining circuit outputs ignition signal and injection signal for each cylinder into said both operating circuits.

13. An internal combustion engine control apparatus according to claim 12, wherein

said control computer outputs a cylinder determination signal, an ignition determination signal, and an injection determination signal into said signal determining circuit,

said control computer changes pulse durations of the ignition determination signal and the injection determination signal in accordance with ignition period and injection period, respectively,

said signal determining circuit carries out cylinder determination and ignition/injection determination based on combinations of the cylinder determination signal, the ignition determination signal and the injection determination signal,

said signal determining circuit determines a pulse duration of the ignition signal based on the pulse duration of the ignition determination signal, and

said signal determining circuit determines a pulse duration of the injection signal based on the pulse duration of the injection determination signal.

14. An internal combustion engine control apparatus for an injection inside cylinder type engine in which a fuel injection valve directly injects fuel into a cylinder, including a combustion detecting circuit detecting a combustion state inside said cylinder through an operating means for said fuel injection valve.

15. An internal combustion engine control apparatus comprising:

an ignition operating circuit;

an injection operating circuit operating a fuel injection valve; and

an energy recovery circuit getting back remaining energy in one of said ignition operating circuit and said injection operating circuit, and supplying the remaining energy into the other operating circuit.